

ANNEX G4. CEPP PIR FLOW EASEMENT BASIN (FEB) PRELIMINARY SEEPAGE ANALYSIS

Geotechnical Seepage Analysis CEPP Flow Easement Basin (FEB)

1. General. This section is a description of the geotechnical seepage analysis performed for the Flow Equalization Basin (FEB) feature associated with the Central Everglades Protection Project (CEPP). The FEB is situated in South Florida and lies south of the Bolles Canal, north of Levee L-5, east of the Miami Canal (L-23) and west of the EAA project. It is to be bordered to the east by the STA3/4 Inflow Canal and to the South by the STA3/4 Supply Canal. The proposed FEB footprint is indicated in Figure G-1.

2. Regional Geology. The regional geologic conditions of the proposed FEB are varied in this area (see Figure G-1). Along the southern boundary near L-5, and the Miami Canal to the west, recent fill materials consisting of poorly graded gravel, sand, silt, and minor amounts of shells vary in thickness from 0.5 foot to 6 feet thick. This fill material extends to other canal areas of Broward County. Below this fill material and throughout most of the surficial cover of northern Broward County, Quaternary shelly-sediments of the Plio-Pleistocene age prevail. The shelly sediments consist of mollusk bearing sediments (sands and carbonates) (P. Schweitzer, 2010). These conditions may also be marginally applicable to the FEB site in Palm Beach County as well.

Below these sediments is the Miami Limestone (Pleistocene) which represents the upper portion of the well-known Biscayne Aquifer. Thickness of the Biscayne Aquifer varies considerably from 10 feet in the northwest end of the county to 240 feet by Ft. Lauderdale which is situated in eastern Broward County (U.S. Geological Survey, 1970); however, the Miami Limestone's maximum thickness is 40 feet toward the coast (U.S. Army of Corps of Engineers, 2011). The Miami Limestone consists of two facies (P. Schweitzer, 2010): an oolitic facies of white to orangish gray, poorly to moderately indurated, sandy, oolitic limestone with scattered concentrations of fossils and a bryozoan facies of white to orangish gray, poorly to well-indurated, sandy, fossiliferous limestone.

The Ft. Thompson Formation represents the base of the Biscayne Aquifer. It is over 200 feet thick in eastern Palm Beach County. This unit consists of alternating beds of marine, brackish and freshwater limestones. The hydraulic conductivity of this formation averages 40,000 feet per day (U.S. Army Corps of Engineers, 2011).

Groundwater within the Biscayne Aquifer is at or near the ground surface and is generally undulating conforming to the topography. The water table commonly slopes eastward toward the coast, except in the Everglades, where it slopes southward. The groundwater table normally lies within the Miami Limestone or organic soils of recent age. Water table fluctuations are heavily influenced by seasonal rainfall, natural discharge, and pumping.

3. Local Geology. The local geology of the FEB feature begins at the surface with peaty material (peaty clay and/or organic sand), generally with an average thickness of 5-8 feet. Below that are undifferentiated layers of sandy, clayey materials of marginal thickness. Below these are consolidated and unconsolidated sediments of the Ft. Thompson formation. The Ft. Thompson limestone is pitted to vuggy with quartz sand-filled voids. The thickness of the Ft. Thompson limestone in this area is indeterminable at this time due to sparse subsurface exploration data.

Underlying the Ft. Thompson formation is the Caloosahatchee Marl which consists of shelly sands and shell marls. Below this formation is the Tamiami Formation which has a maximum depth of 65 feet to the top of the formation. This is the base of the unconfined water-table aquifer (Schroeder et al, 1954). Within the FEB, the majority of the surficial soils are Histosols which includes Everglades peats and Loxahatchee peats (Gleason et al., 1974; Bruland, 2006). According to Gleason et al, 1974, Everglades peats develop on topographic high areas and are comprised of *Cladium* tissue. Everglades peats are typically brown to black with minimal mineral content. Loxahatchee peats are found in topographic low areas and are composed of the remains of the roots and rhizomes of *Nymphaea*, a white water lily. Loxahatchee peats have been classified as the Terra Ceia series (Euic, hyperthermic Typic Haplosaprists) (Soil Conservation Service, 1978). The western margin of WCA-3A is mixed marl peats that are derived from the underlying limestone (Brown et al., 1991).

4. Seismicity. South Florida is considered to be one of the most seismically stable locations in the United States (Petersen, Mark D. et. al, 2008). Historically, only minor shocks have occurred, with only one that resulted in damage. Additional shocks of suspect origin have been recorded that were felt in the Everglades area. The three Florida shocks of doubtful seismic origin rumbled through the Everglades, La Belle/Fort Myers area in July 1930, Tampa in December 1940, and the Miami/Everglades/Fort Myers area in January 1942. Most authorities attributed these incidents to blasting, but a few contend that they were seismic.

ER 1110-2-1806, (1995) indicates that South Florida is in Seismic Zone 0 (areas with least potential for seismic activity). Since no capable faults or recent earthquake epicenters are known to exist near the project site, the possibility of accelerations at the site approaching that required to induce liquefaction of the subsurface is remote. However, since this is a planned permanent impoundment and the underlying soils contain loose sand and silt granular material, a liquefaction screening evaluation will be conducted in accordance with CERP Design Criteria Memorandum No. 6. This screening will be conducted once the geotechnical investigations are completed.

5. Existing Project Data. There is only a sparse amount of subsurface geotechnical data available for the FEB. Existing subsurface used to develop the eastern dike seepage analysis cross section was taken from the EAA Reservoir A-1 Geotechnical Data Report of March 2006. A core boring and recharge test was also taken within the reservoir area with the core boring log CP02-EAARS-CB-0002 presented in Appendix G-1. This information was obtained from Report No. 02-042, Ardaman and Associates, 2003. To evaluate the seepage on the west side of the FEB, C & SF Part I Agricultural and Conservation Areas, Supplement 1 – Geology and Soils, December, 1951 provided geologic cross sections that provide subsurface information for the north and west sides of the proposed FEB impoundment. The western boundary subsurface profile can be approximately defined by Figure G-2 along L-23 from sta. 0+00 to sta. 600+00. The northern subsurface boundary of the FEB can be approximated by the cross sections taken along L -22 shown on Figures G-3 and G-4 from sta. 532+18 to sta. 0+00.

6. Seepage Model. The seepage analysis was performed on two sections of the proposed perimeter levee and canal system. The models consist of one typical section for the east dike and one of the west dike. A copy of the idealized geometry and water surface elevations used in the seepage analysis are shown on Figures G-5 and G-6. The computational tool used to model the seepage for the east and west cross sections was the two dimensional finite element program SEEP/W. The east and west SEEP/W representations of the input model are shown on Figures G-7 and G-8. Layers and hydraulic input parameters used in the SEEP/W cross sections are provided in Tables G-1 and G-2. The impoundment water level was kept at el. 10.0 ft with tailwater at the dike toe at elevation 6.0 ft.

The subsurface characterization for the model was conducted using an idealized geologic profile utilized for the EAA project immediately east of the project feature site. Due to the extremely limited geotechnical exploration data in the area of the FEB footprint, the modeled results presented provide only a tentative estimate of seepage quantities. The western cross section model was based on a recharge test at location RT-2 near core boring CP02-EAARS-CB-0002. This boring, which is located in the middle of the proposed reservoir, was performed in the 2003 geotechnical exploration program for the EAA and as described by Report No. 02-042, Ardaman and Associates, 2003. Other subsurface information used for development of the west section model was the C & SF Part I Agricultural and Conservation Areas, Supplement 1 – Geology and Soils, December, 1951 and C & SF Part I Agricultural and Conservation Areas, Supplement 7 – Permeability Investigations by Well Pumping Tests, February, 1953, and Report of Investigations No. 13 (RI-13), Water Resources of Palm Beach County, Florida, 1954.

Table G-1. Eastern Seepage Model Cross Section Material Properties

Layer	Elevation Extent (feet)	Kx, Horizontal Hydraulic Conductivity (fpd)	Anisotropy Ratio, Ky/Kx
Dike Sand	EL. 15.0->EL. 6.0	3.0	1.0
Caprock Limestone	EL. 6.0->EL.3.0	100	0.1
Upper Okeechobee-Upper Limestone	EL. 3.0-> -13.0	60	0.42
Upper Okeechobee-Lower Limestone	EL. -13.0 ->-24.0	200	0.375
Lower Okeechobee-Upper Sands	EL. -24.0 ->-56.2	250	0.5
Tamiami Formation	EL. -56.20 ->-89.9	36	0.5

Table G-2. Western Seepage Model Cross Section Material Properties

Layer	Elevation Extent (feet)	Kx, Horizontal Hydraulic Conductivity (fpd)	Anisotropy Ratio, Ky/Kx
Dike Sand	EL. 15.0->EL. 6.0	3.0	1.0
Caprock Limestone	EL. 6.0->EL.3.0	283	0.1
Upper Okeechobee- Upper Limestone	EL. 3.0-> -13.0	72	0.42
Upper Okeechobee- Lower Limestone	EL. -13.0 ->-24.0	200	0.375
Lower Okeechobee- Upper Sands	EL. -24.0 ->-56.2	250	0.5
Tamiami Formation	EL. -56.20 ->-89.9	36	0.5

The regional hydrogeologic features of the project feature area show the surficial aquifer of sand, shell and limestone tends to thicken from the western boundary at Hendry County to the eastern edge of Palm Beach County. However, from north to south, the surficial aquifer top limestone beds thicken somewhat from Lake Okeechobee to about five miles south where they become more uniform in thickness. Supplement 1 (1951) indicates the presence of cavities in the top layers of the limestone in selected borings from 1-3 feet in thickness. These, however, do not seem to be continuous, at least along the line of borings. These features may have a profound effect on the hydraulic conductivity of the subsurface strata on the west side of the reservoir. To compensate for this, the hydraulic conductivities for the east section model were increased by 20% to account for a roughly 5.2% increase in porosity over the strata matrix hydraulic conductivity values. The caprock permeability in the west section model was increased from 100 ft/day to 283 ft/day based on results of the recharge test of Report No. 02-042 (2003).

The resulting seepage quantity for the east section was 320 cubic feet/day/ft of levee, and for the west section the seepage quantity was 387 cubic feet/day/ft of levee.

7. Future Geotechnical Investigations. The seepage quantities presented for the FEB are tentative estimates. As they are a basis for the project estimate, the subsurface materials need to be characterized by a geotechnical exploration and laboratory testing program. There is a very real possibility that previous core borings did not pick up key flow channels within the underlying limerock layers and these could be so conducive to flow that they will control the seepage losses for the reservoir. In addition, laminar flow assumptions used in the Darcy's Law based models may not be applicable in some areas. Scaled test sections at the adjacent EAA project show that maintaining an operating reservoir head level over an extended period of time may be difficult without seepage control systems such as cutoff walls or reservoir bottom treatment. Furthermore, there is a potential for piping of embankment material if there are cavities and natural pipes in the levee foundation. A comprehensive geotechnical exploration program featuring components such as reservoir foundation clearing and mapping along with geophysical testing, full-scale pump testing

along with design stage core boring exploration and geotechnical laboratory testing will be required. It is recommended to begin planning for such investigations as expeditiously as possible.

8. Borrow Materials. Sands from the proposed existing borrow from the exterior canal can be used as dike fill material. Whether they can be used without processing of limestone rock fragments is to be determined. With removal of organic surficial soils, dike foundation bearing and tolerable settlement levels are anticipated.

REFERENCES

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Figure G-1. Aerial Photograph of Project Site

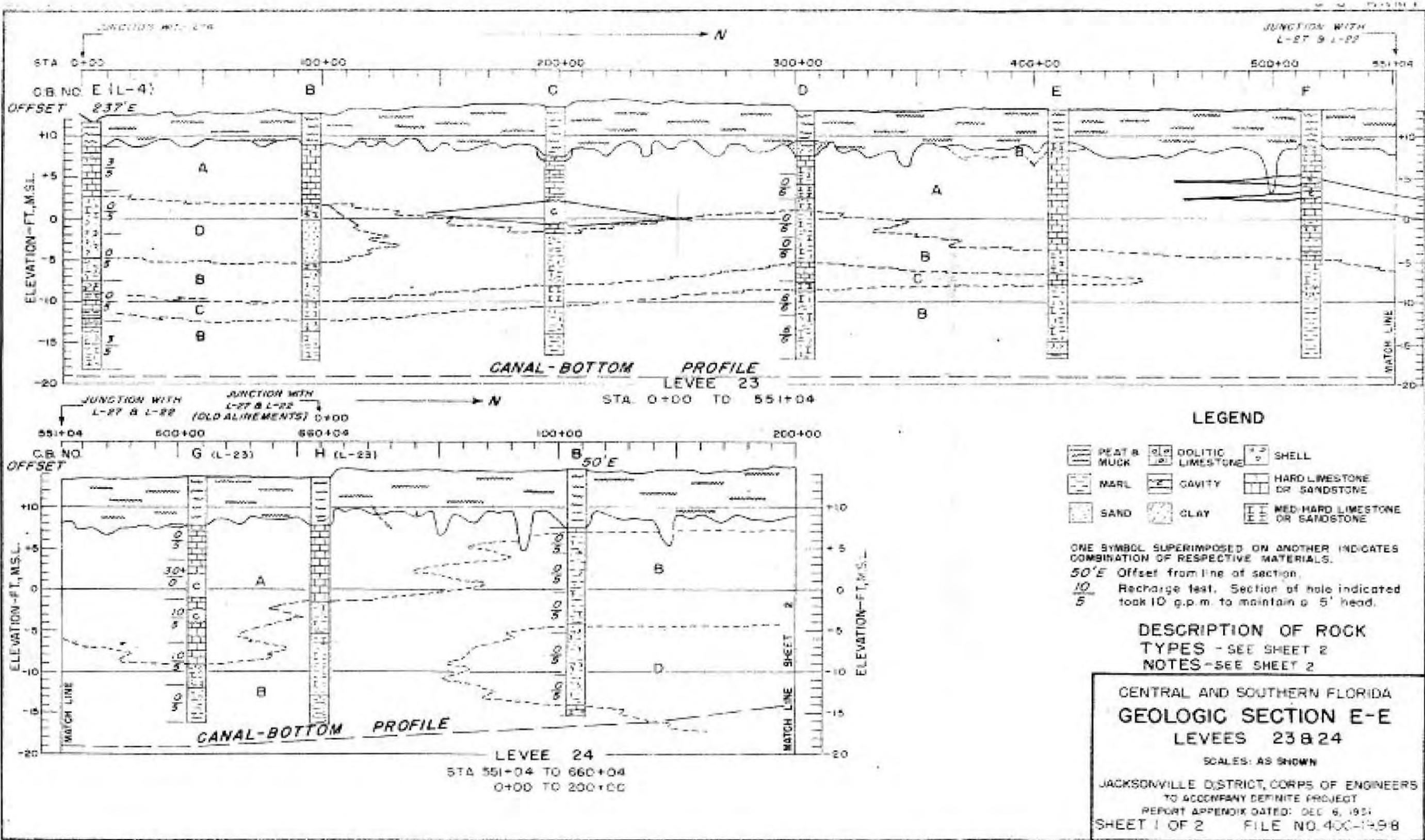


PLATE 27

Figure G-2. Geologic Section L-23 & L-24

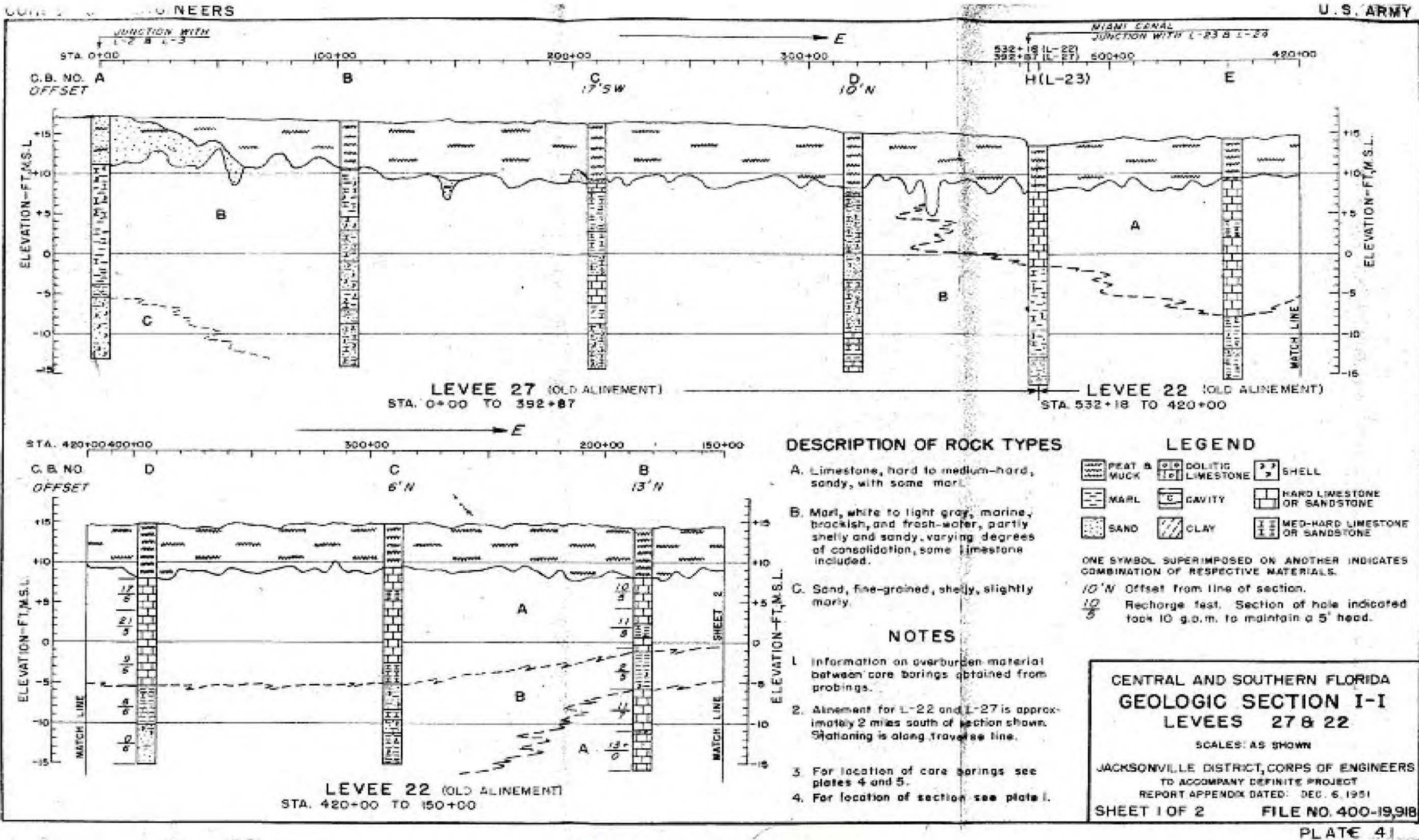


Figure G-3. Geologic Section L-27 & L-22

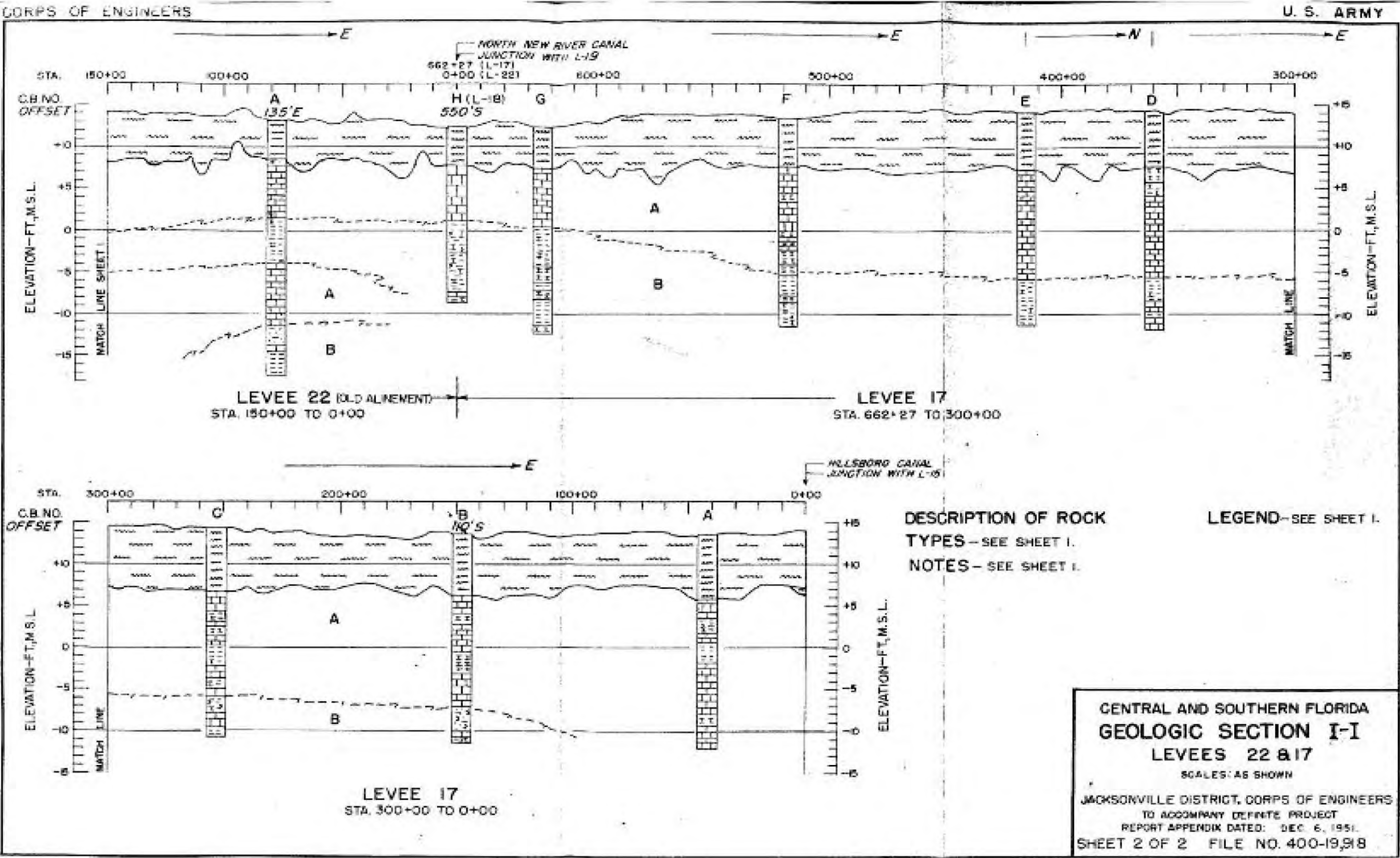


Figure G-4. Geologic Section L-22 & L-17

PLATE 42

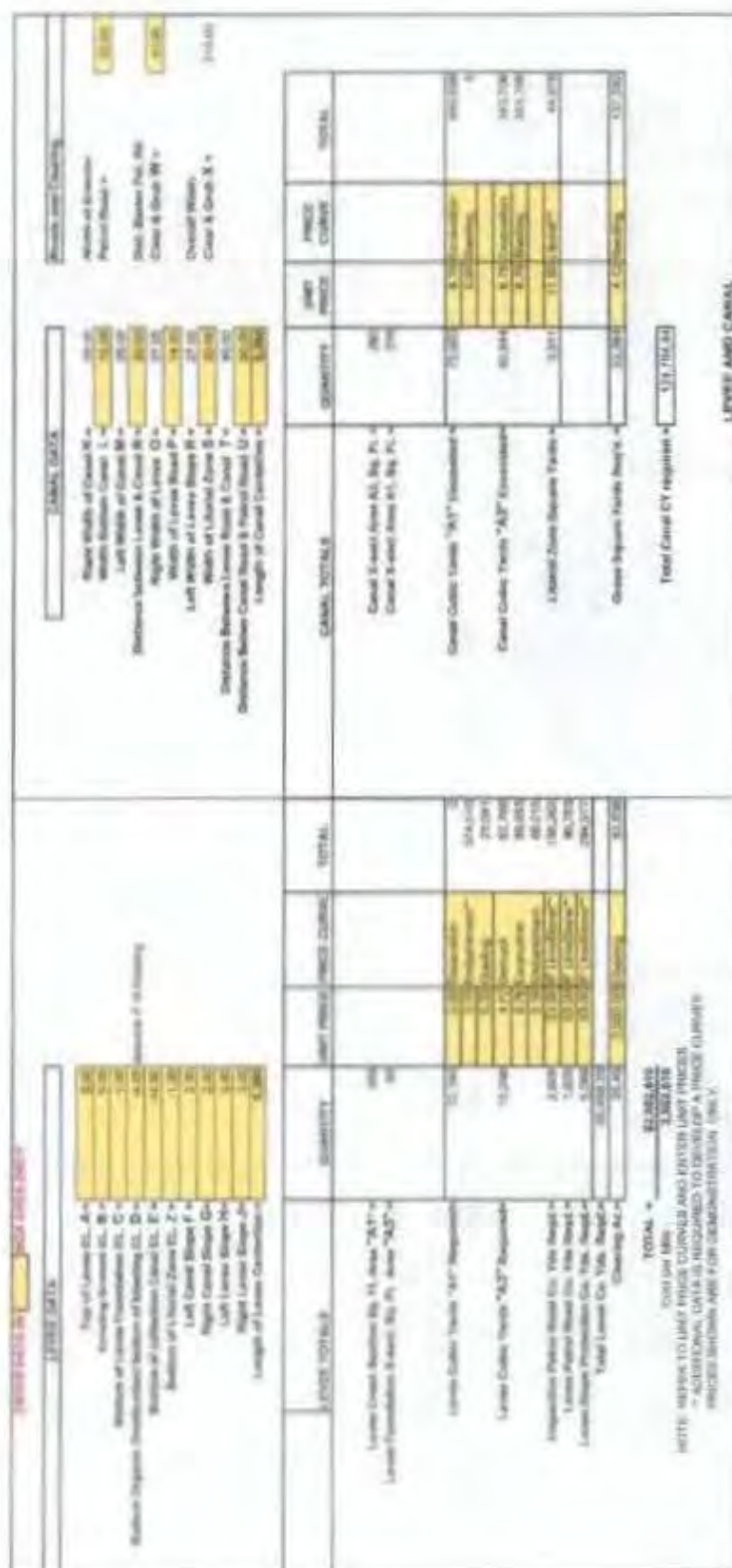


Figure G-5. FEB Seepage Model Input Data

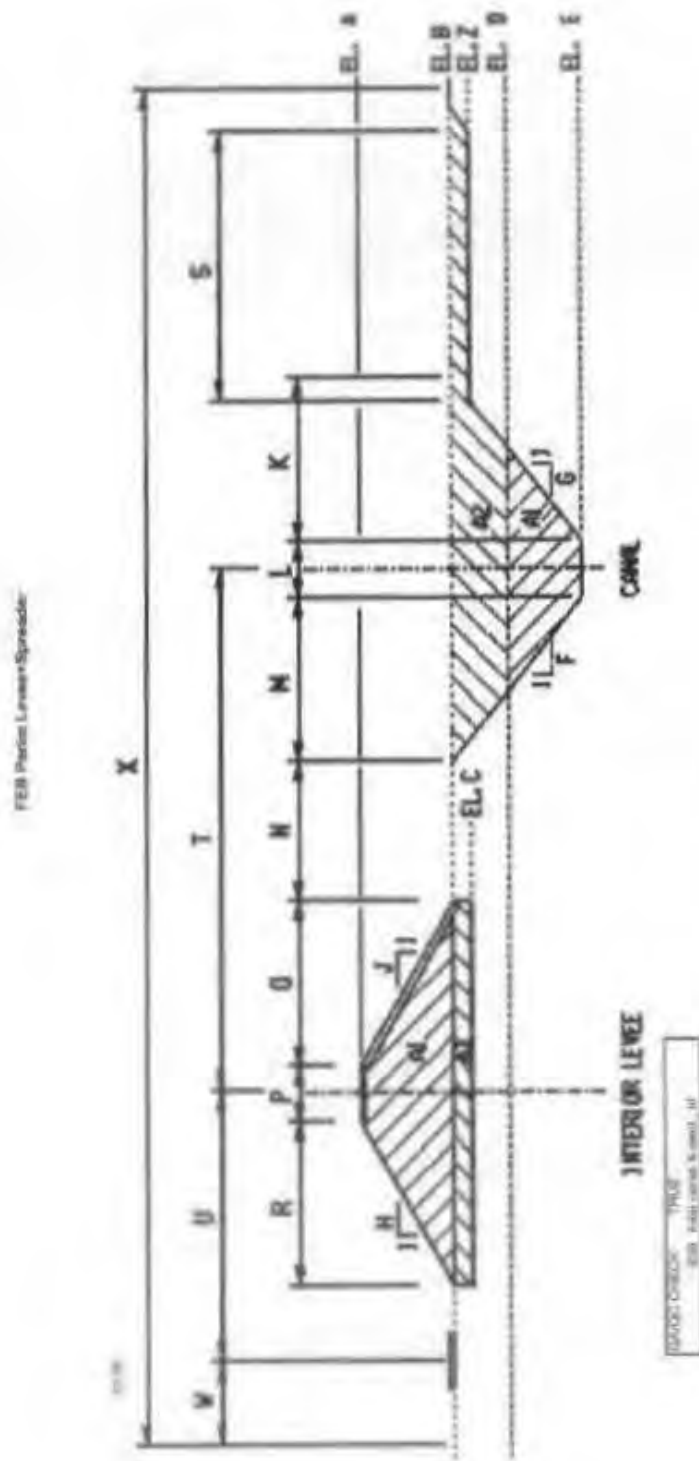
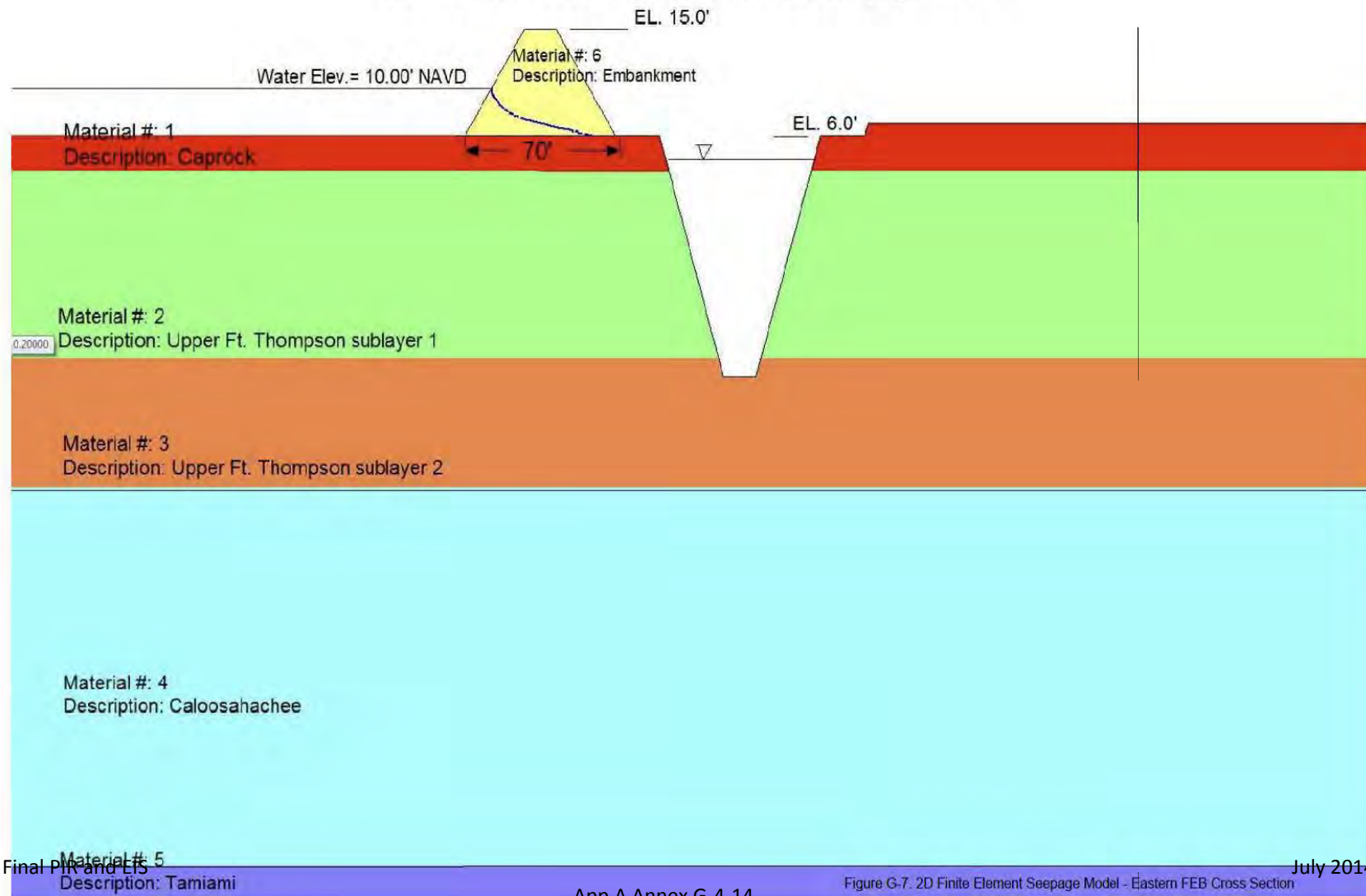
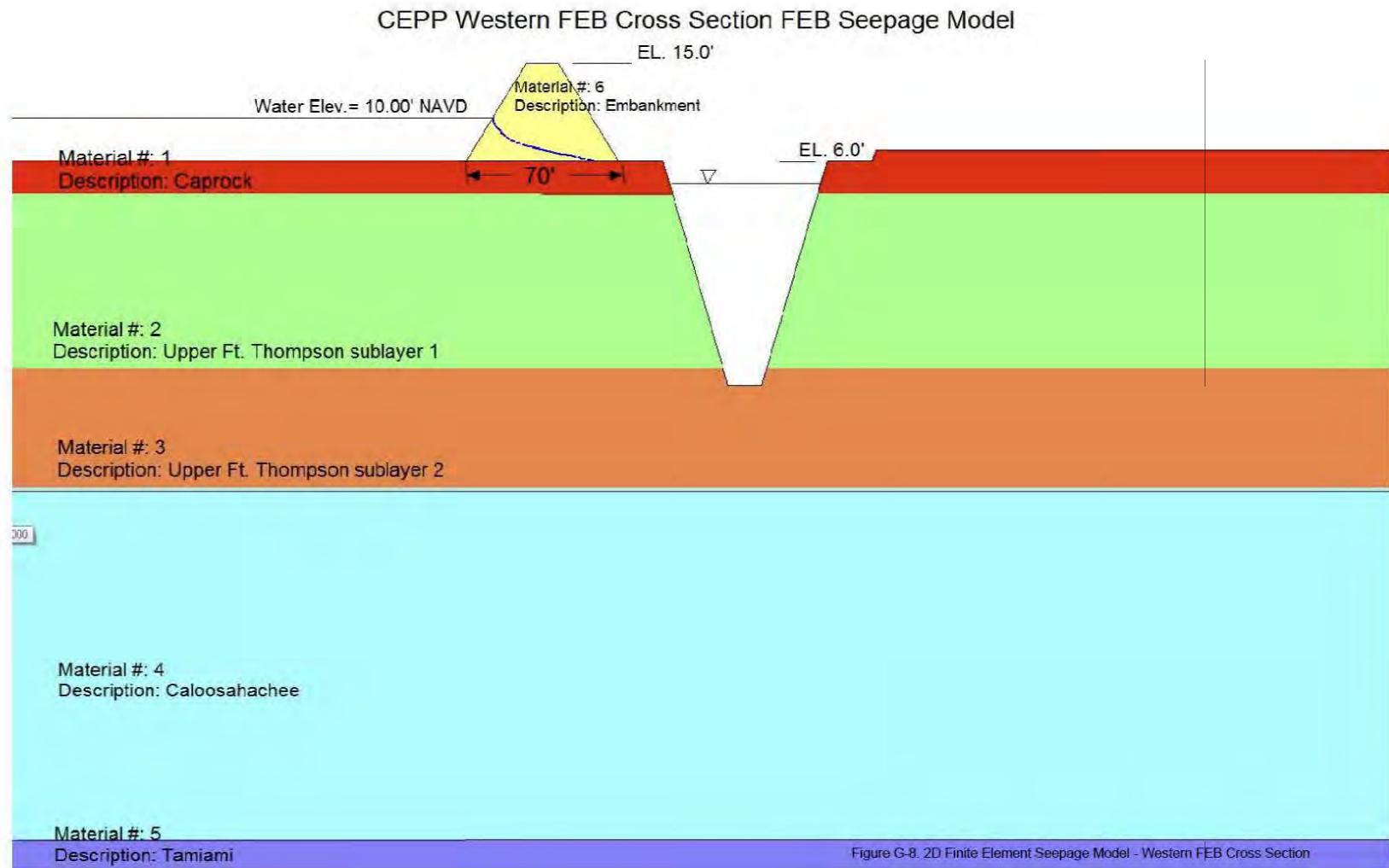


Figure G-6. FEB Seepage Model Idealized Cross Section Geometry

CEPP Eastern FEB Cross Section FEB Seepage Model





APPENDIX G
CORE BORING
CP02-EAARS-CB-0002

Boring Designation CP02-EAARS-CB-0002

DRILLING LOG		DIVISION		INSTALLATION		SHEET 1		
		South Atlantic		Jacksonville District		OF 10 SHEETS		
1. PROJECT				9. SIZE AND TYPE OF BIT				
CERP Everglades Agricultural Area Reservoirs				See Remarks				
Phase 1, Effort 1, Compartment A								
2. BORING DESIGNATION		LOCATION COORDINATES		10. COORDINATE SYSTEM/DATUM		HORIZONTAL		
CP02-EAARS-CB-0002		X = 736,775 Y = 775,528		State Plane, FLE		NAD83		
3. DRILLING AGENCY		CONTRACTOR FILE NO.		11. MANUFACTURER'S DESIGNATION OF DRILL		<input type="checkbox"/> AUTO HAMMER		
Ardaman & Associates, Inc.		02-042		CME-55		<input checked="" type="checkbox"/> MANUAL HAMMER		
4. NAME OF DRILLER				12. TOTAL SAMPLES		DISTURBED		
M. Gulick				118		UNDISTURBED (UD)		
5. DIRECTION OF BORING		DEG. FROM VERTICAL		13. TOTAL NUMBER CORE BOXES		5		
<input checked="" type="checkbox"/> VERTICAL				14. ELEVATION GROUND WATER		Not Determined		
<input type="checkbox"/> INCLINED				15. DATE BORING		STARTED		
				08-13-02		COMPLETED		
				08-03-02				
6. THICKNESS OF OVERBURDEN		5.4 Ft.		16. ELEVATION TOP OF BORING		12.0 Ft.		
7. DEPTH DRILLED INTO ROCK		13.5 Ft.		17. TOTAL RECOVERY FOR BORING		80 %		
8. TOTAL DEPTH OF BORING		180.0 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR				
				H. Snyder, Civil Engineer				
ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REG.	BOX OR RQD	REMARKS	BORE 0.5 FT.	N-VALUE
12.0	0.0		FILL, gravelly, mixture of fine gravel size limestone, fine to coarse grained limestone sand, and silt, dry, light gray	13	1	SPT Sampler	32	0
				40	2	SPT Sampler	6	40
9.0	3.0		SAND, silty, mostly fine-grained, some silt, dry, dark brown (SM)	47	3	SPT Sampler	1	12
8.0	2.2		Limestone, hard, slightly weathered, medium-grained, porous to pitted, light gray-green	100	4	SPT Sampler	16	5
				50	6	4 x 5-1/2" Diamond Impregnated Bit DT = 80 mins HP = 100 psi	2.0	10
5.0	7.0		Limestone, moderately hard	100	7	4 x 5-1/2" Diamond Impregnated Bit 9 mins, 100 psi	0.9	33
				80	8	SPT Sampler	4	
				50	9	SPT Sampler	29	
				45	10	4 x 5-1/2" Diamond Impregnated Bit DT = 23 mins HP = 100 psi	50/0.4'	15

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Boring Designation CP02-EAARS-CB-0002

DRILLING LOG (Cont. Sheet)				INSTALLATION		SHEET 2 OF 10 SHEETS			
PROJECT				COORDINATE SYSTEM/DATUM		HORIZONTAL	VERTICAL		
CERP Everglades Agricultural Area Reservoir				State Plane, FLE		NAD83	NAVD83		
LOCATION COORDINATES				ELEVATION TOP OF BORING					
X = 736,776 Y = 775,523				12.0 Ft					
ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OF SAMPLE	ROD OR CH	REMARKS	BLOWN B.S.F.T.	N-VALUE
-4.0	16.0		At El. -3.0 Ft. vuggy	45	BOX	ROD	4 x 5-1/2" Diamond Impregnated Bit DT = 23 mins HP = 100 psi		15
			Limestone, hard, unweathered, fine-grained, vuggy, trace of shell, gray	NR	11		SPT Sampler		
				84	BOX	ROD	4 x 5-1/2" Diamond Impregnated Bit DT = 15 mins HP = 100 psi		
				70	BOX	ROD	4 x 5-1/2" Diamond Impregnated Bit 8 mins, 100 psi		20
			At El. -9.0 Ft. (little shell)	33	14		SPT Sampler	5 7	15
			At El. -10.6 Ft. (trace silt)	47	15		SPT Sampler	6 7 9	19
-12.0	24.0		SAND, poorly-graded with silt, some angular fine-grained quartz, some fine-grained limestone, little angular shell, trace phosphate, light brown (SP-SM)	47	16		SPT Sampler	10 11	21
				47	17		SPT Sampler	10 11	21
-15.0	27.0		SAND, silty, mostly fine-grained quartz, trace angular fine-grained shell, trace clay, trace phosphate, light gray (SM)	73	18		SPT Sampler	8 9	18
			At El. -17.0 Ft. (little clay)	87	19		SPT Sampler	7 6	12
				87	20		SPT Sampler	6 5	10
-19.6	31.6		SAND, poorly-graded with silt, mostly fine-grained quartz, little shell, few silt, light brown (SP-SM)	73	21		SPT Sampler	5 8 12	20
				73	22		SPT Sampler	10 11	24
-22.6	34.6		SAND, poorly-graded, mostly fine to	75	23		SPT Sampler	13 11	36

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Boring Designation CP02-EAARS-CB-0002

DRILLING LOG (Cont. Sheet)			INSTALLATION Jacksonville District		SHEET 3 OF 10 SHEETS			
PROJECT CERP Everglades Agricultural Area Reservoirs			COORDINATE SYSTEM/DATUM State Plane, FLE		HORIZONTAL NAD83	VERTICAL NAVD83		
LOCATION COORDINATES X = 736.775 Y = 775.526			ELEVATION TOP OF BORING 12.0 FL					
ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	SPT BLOW COUNT	REMARKS	BLOW COUNT 0-10 FT.	N-VALUE
			medium-grained quartz, some angular fine to medium-grained shell, few phosphate, trace silt, light brown to light gray (SP)	75	23	-24.0 SPT Sampler	11	22
			At El. -24.0 Ft., trace shell, trace of shell	93	24	SPT Sampler	6	15
				67	25	SPT Sampler	7	10
				67	26	SPT Sampler	5	13
				73	27	SPT Sampler	4	12
			At El. -30.0 FL, trace fine gravel-sized shell	60	28	SPT Sampler	5	13
				93	29	SPT Sampler	6	11
				80	30	SPT Sampler	7	18
			At El. -34.5 FL, trace fine gravel-sized limestone	93	31	SPT Sampler	10	19
				93	32	SPT Sampler	8	63
			Limestone, hard, fine-grained, trace of silt, few fine grained sand, trace of clay, gray	53	33	SPT Sampler	29	15
				80	34	SPT Sampler	14	11
			SAND, poorly-graded, mostly fine-grained shell, trace coarse gravel-sized phosphate, trace clay, gray (SP)	73	35	SPT Sampler	6	45
			From El. -40.5 to -45.0 FL, mostly medium to coarse-grained shell, trace fine gravel-sized shell, trace clay, light brown	87	36	SPT Sampler	9	
						SPT Sampler	4	
						SPT Sampler	5	
						SPT Sampler	11	
						SPT Sampler	19	
						SPT Sampler	26	
						SPT Sampler	17	
						SPT Sampler	20	

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Boring Designation CP02-EAARS-CB-0002

DRILLING LOG (Cont. Sheet)				INSTALLATION		SHEET 4		
				Jacksonville District		OF 10 SHEETS		
PROJECT				COORDINATE SYSTEM/DATUM		HORIZONTAL	VERTICAL	
CERP Everglades Agricultural Area Reservoirs				State Plane, FLE		NAD83	NAVD88	
LOCATION COORDINATES				ELEVATION TOP OF BORING				
X = 736.775 Y = 775.528				12.0 FL				
ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	NO. OF SPT BLows	REMARKS	SPT BLow Value	N-VALUE
				87	36	-43.6 SPT Sampler	19	39
							15	
				87	37	SPT Sampler	19	41
-45.0	57.0					-45.0	22	
							12	
			SAND, poorly-graded with clay, mostly medium-grained sand, little clay, little angular shell, trace fine gravel-sized shell, gray (SP-SC)	100	38	SPT Sampler	16	29
						-46.6	13	
			At El. -47.0 Ft., few shell, trace clay	60	39	SPT Sampler	17	36
						-48.0	19	60
							10	
				93	40	SPT Sampler	14	28
-49.6	61.5					-49.6	14	
			SAND, clayey, mostly fine to medium-grained sand, some clay, little fine gravel-sized shell, gray (SC)	87	41	SPT Sampler	10	50
						-51.0	31	
				93	42	SPT Sampler	10	25
						-52.6	12	
			At El. -52.6 Ft., some shell, trace clay, lens of clay	73	43	SPT Sampler	13	65
						-54.0	20	
				100	44	SPT Sampler	10	22
-55.6	67.5					-55.6	11	
			SAND, poorly-graded with clay, mostly shell (SP-SC)	67	45	SPT Sampler	10	28
						-57.0	12	
							16	
				93	46	SPT Sampler	15	26
						-58.6	14	70
							12	
				53	47	SPT Sampler	11	28
						-60.0	12	
							16	
				67	48	SPT Sampler	18	33
			At El. -61.6 Ft., mostly shell			-61.6	14	
							19	
				67	49	SPT Sampler	6	
							12	27
						-63.0	15	

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Boring Designation CP02-EAARS-CB-0002

DRILLING LOG (Cont. Sheet)				INSTALLATION Jacksonville District		SHEET 6 OF 10 SHEETS			
PROJECT CERP Everglades Agricultural Area Reservoirs				COORDINATE SYSTEM/DATUM State Plane, FLE		HORIZONTAL NAD83	VERTICAL NAVD88		
LOCATION COORDINATES X = 736,775 Y = 775,528				ELEVATION TOP OF BORING 12.0 Ft.					
ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	NO. OF SAMPLES	ROD COR COR	REMARKS	BLOWS 0.5 FT.	N-VALUE
-63.8	75.7		Limestone, fine-grained, trace of clay, trace of phosphate, gray	93	50		SPT Sampler	20	75
								18	36
							-64.6	18	
						53	51	SPT Sampler	14
								16	
-66.0	78.0		SAND, poorly-graded, mostly fine to medium-grained quartz, trace sandstone, trace shell, light gray (SP)				-65.0	17	33
						67	52	SPT Sampler	10
								40	
							-67.6	45	85
				67	53	SPT Sampler	26		80
								32	
							-69.0	49	81
								36	
				100	54	SPT Sampler	65		122
							-70.6	57	
								10	
				87	55	SPT Sampler	14		
							-72.0	20	34
								14	
				93	56	SPT Sampler	28		85
							-73.6	29	
								14	
				53	57	SPT Sampler	17		
							-75.0		
								8	
				87	59	SPT Sampler	18		47
							-76.6	29	
								24	
				87	60	SPT Sampler	34		76
							-78.0	42	
								9	90
				73	61	SPT Sampler	18		
							-79.6	20	38
								4	
-80.6	92.5		From El. -79.6 to -80.6 Ft., mostly coarse-grained quartz, trace phosphate, trace shell, trace sandstone, light gray	93	62	SPT Sampler	10		16
									6
			SAND, clayey, mostly medium to coarse-grained sand, some clay, trace phosphate, trace shell, gray (SC)					5	
						100	63	SPT Sampler	7
			At El. -82.0 Ft., trace sand				-82.6	12	
			At El. -82.6 Ft., little shell, little limestone	100	64	SPT Sampler	3		

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Boring Designation CP02-EAARS-CB-0002

DRILLING LOG (Cont. Sheet)				INSTALLATION Jacksonville District		SHEET 6 OF 10 SHEETS				
PROJECT CERP Everglades Agricultural Area Reservoirs				COORDINATE SYSTEM/DATUM State Plane, FLE		HORIZONTAL NAD83		VERTICAL NAVD88		
LOCATION COORDINATES X = 736,775 Y = 775,528				ELEVATION TOP OF BORING 12.0 Ft.						
ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	SEE BOX SAMPLER	ROD OR UD	REMARKS	BLOW/0.5 FT.	N VALUE	
			At El. -84.0 Ft., trace sand	100	64		SPT Sampler	9	16	
							-84.0	7		
					100	65		SPT Sampler	10	
							-85.6	8	17	
			At El. -86.0 Ft., trace limestone	87	66		SPT Sampler	18		
							-87.0	21	47	
				At El. -87.0 Ft., some shell				26		
					67	67		SPT Sampler	12	
-88.6	100.5							22	51	
							-88.6	29	100	
				SAND, clayey, mostly fine to coarse-grained sand, some clay, few shell, trace phosphate, gray (SC)	100	68		SPT Sampler	14	
							-90.0	9	23	
-90.0	102.0							14		
							-90.0	14		
				Sandstone, fine-grained, few shell, trace of clay, trace of phosphate, gray	67	69		SPT Sampler	5	
							-91.6	16	36	
					100	70		SPT Sampler	20	
							-93.0	17	33	
					87	71		SPT Sampler	9	105
							-94.6	17	36	
					67	72		SPT Sampler	19	
							-96.0	30	49	
					73	73		SPT Sampler	19	
							-97.6	23	42	
				At El. -98.0 Ft., few clay	93	74		SPT Sampler	24	110
							-99.0	21	43	
				93	75		SPT Sampler	22		
						-100.6	24	43		
				93	76		SPT Sampler	19		
						-102.0	18			
				87	77		SPT Sampler	15	35	
								20		
								14		
								16		

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Boring Designation: CP02-EAARS-CB-0002

DRILLING LOG (Cont. Sheet)			INSTALLATION Jacksonville District		SHEET 7 OF 10 SHEETS			
PROJECT CEPP Everglades Agricultural Area Reservoirs			COORDINATE SYSTEM/DATUM State Plane, FLE		HORIZONTAL NAD83	VERTICAL NAVOD88		
LOCATION COORDINATES X = 736.775 Y = 775.528			ELEVATION TOP OF BORING 12.0 Ft					
ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	REC.	BOX OR SAMPLE	REMARKS	BLVD ELEV.	N-VALUE
				87	77	-103.6 SPT Sampler	17	33
				87	78	SPT Sampler	15	
						-105.0	17	31
							14	
				93	79	SPT Sampler	12	
						-106.6	10	21
							11	
				100	80	SPT Sampler	13	
						-108.0	17	33
							16	
				93	81	SPT Sampler	12	
						-109.6	14	32
							16	
				87	82	SPT Sampler	17	
						-111.0	22	39
							17	
				93	83	SPT Sampler	12	
						-112.6	10	32
							16	
				73	84	SPT Sampler	14	
						-114.0	22	41
							19	
				87	85	SPT Sampler	15	
						-115.6	14	27
							13	
				93	86	SPT Sampler	14	
						-117.0	13	26
							13	
				73	87	SPT Sampler	14	
						-118.6	14	24
							10	
				87	88	SPT Sampler	9	
						-120.0	10	25
							15	
				80	89	SPT Sampler	26	
						-121.6	15	31
							16	
				87	90	SPT Sampler	23	
						-123.0	24	42
							18	

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Boring Designation: CP02-EAARS-CB-0002

DRILLING LOG (Cont. Sheet)				INSTALLATION			SHEET 8 OF 10 SHEETS		
PROJECT CERP Everglades Agricultural Area Reservoirs				JACKSONVILLE DISTRICT					
LOCATION COORDINATES X = 736,775 Y = 775,528				COORDINATE SYSTEM/DATUM State Plane, FLE			HORIZONTAL NAD83		
							VERTICAL NAVD88		
				ELEVATION TOP OF BORING 12.0 FL					
ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	ROD COR	REMARKS	BLDG. ELEV.	N-VALUE
				60	91		SPT Sampler	9	135
								10	21
							-124.6	11	
				93	92		SPT Sampler	17	
								24	43
							-126.0	19	
				80	93		SPT Sampler	25	
								28	48
							-127.6	20	
				73	94		SPT Sampler	14	140
								18	37
							-129.0	19	
				87	95		SPT Sampler	12	
								16	55
							-130.6	39	
-131.0	143.0							31	
				100	96		SPT Sampler	37	61
								24	
							-132.0	17	
				100	97		SPT Sampler	21	145
								17	38
							-133.6	14	
				100	98		SPT Sampler	16	36
								20	
							-135.0	12	
				100	99		SPT Sampler	25	52
								27	
							-136.6	12	
				100	100		SPT Sampler	18	36
								18	
							-138.0	11	150
				93	101		SPT Sampler	16	34
								18	
							-139.6	10	
				100	102		SPT Sampler	16	38
								22	
							-141.0	15	
				67	103		SPT Sampler	26	51
								25	
							-142.6	18	
-142.6	154.5		Sandstone, fine-grained, some quartz sand,	80	104		SPT Sampler		155

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JUN 02

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Boring Designation CP02-EAARS-CB-0002

DRILLING LOG (Cont. Sheet)				INSTALLATION Jacksonville District			SHEET 9 OF 10 SHEETS		
PROJECT CERP Everglades Agricultural Area Reservoirs				COORDINATE SYSTEM/DATUM State Plane, FLE		HORIZONTAL NAD83	VERTICAL NAVD88		
LOCATION COORDINATES X = 736,775 Y = 775,528				ELEVATION TOP OF BORING 12.0 Ft.					
ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	REC.	BOX OR SAMPLE	ROD OR LOG	REMARKS	SLOTT. BLAST	N VALUE
			few clay, trace shell, trace phosphate, gray At El. -143.0 Ft., few shell	80	104		SPT Sampler	20	39
							-144.0	19	
				93	105		SPT Sampler	25	
							-145.6	22	46
			At El. -145.6 Ft., trace clay					24	
				100	106		SPT Sampler	9	
							-147.0	17	58
								41	
				73	107		SPT Sampler	16	
							-148.6	20	40
								20	
				80	108		SPT Sampler	15	
							-150.0	17	36
								19	
				80	109		SPT Sampler	30	
							-151.6	20	38
								18	
				73	110		SPT Sampler	18	
							-153.0	16	37
								21	
				80	111		SPT Sampler	14	185
							-154.6	16	
								18	34
				80	112		SPT Sampler	10	
							-156.0	18	37
								19	
				73	113		SPT Sampler	6	
							-157.6	17	31
								14	
				100	114		SPT Sampler	14	170
							-159.0	14	
-159.0	171.0							16	30
			SAND, poorly-graded, mostly fine to medium-grained quartz, trace fine gravel-sized sandstone, trace phosphate, light gray (SP)	100	115		SPT Sampler	15	
							-160.6	24	43
								19	
-161.0	173.0		Sandstone, medium-grained, some quartz sand, few clay, few shell, trace of phosphate, gray	100	116		SPT Sampler	14	
							-162.0	17	28
								11	
				87	117		SPT Sampler	24	
								24	

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Boring Designation: CP02-EAARS-CB-0002

DRILLING LOG (Cont. Sheet)			INSTALLATION Jacksonville District		SHEET 10 OF 10 SHEETS				
PROJECT CERF Everglades Agricultural Area Reservoirs			COORDINATE SYSTEM DATUM State Plane FLE		HORIZONTAL NAD83	VERTICAL NAVD85			
LOCATION COORDINATES X = 736.775 Y = 775.528			ELEVATION TOP OF BORING 12.0 FL						
ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	NO. OF SPT BLASTS	NO. OF OR UB	REMARKS	BLOWS/ 0.5 FT.	W VALUE
-166.0	180.0			37	117		-163.0 SPT Sampler	18	42
								18	
				57	118		SPT Sampler	18	34
							-165.0	18	
								17	
				100	119		SPT Sampler	18	37
							-166.6	19	
								25	
				100	120		SPT Sampler	25	65
							-168.0	29	150
			NOTES:				140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).		
			1. Soils are field visually classified in accordance with the Unified Soils Classification System.				Abbreviations: NR = Not Recorded DT = Drill Time HP = Hydraulic Pressure		
			2. Laboratory Testing Results						
			SAMPLE ID SAMPLE DEPTH LABORATORY CLASSIFICATION						
			119 177.0/178.5 *						
			*Lab visual classification based on gradation curve. No Atterberg limits.						
			3. Additional Laboratory Testing						
			119 Moisture Content						

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